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ABSTRACT

Quality education is often impeded by lack of instructor time and by a failure to provide instruction that is individualized and at the point of need. Integration technology into course development can alleviate these problems, but only if the technology is easy to learn and supports a systems approach. In implementing a Web-based Technical Sketching course at Purdue University (Indiana), a systems approach was used to design, develop, and distribute the electronic course materials. The four-part systems model includes people, environment, processes, and technology. The first step is to identify the participants in the system; in this case, students and instructors are the receivers (customers) of the development effort. The environment consists of traditional sketching tools and access Web-enabled computers for the customers. Processes relative to the sketching course content include psychomotor, affective, and cognitive knowledge activities. Technology manifests itself in the form of Web-enabled computers, browser software, and printers for instructors and students. The course developer needs supporting electronic data files, HTML translation software, image mapping software, ftp software, and other specialty software. The combination of Microsoft NT or Windows 95 and the Web authoring aid FrontPage provides the technology components necessary to create and distribute Web-based instructional materials. The next step is for course developers to create and distribute customized learning environments that are visually rich and dynamic. A proposed "Just-In-Time-Training" (JITT) system would involve an Internet component comprised of user information services, a private intranet for class-specific information like grades and personal data, and a development area where the project testing and experimentation would reside. (AEF)

Visual Literacy And Just-In-Time-Training: Enabling Learners Through Technology

by Terry Burton

Abstract

It is extensively documented that the best time to provide information is when the learner is prepared and/or in need of receiving it. Until recently, the ability of educators to provide dynamic customized information that is timely and efficient has been limited or non-existent. With the creation of an electronic communication infrastructure and the development of affordable computer technology, course developers and administrators now have at their disposal a unique tool set to accomplish what the author calls Just-In-Time-Training (JITT).

Introduction

"Better to be at the bottom of the right mountain, than halfway up the wrong mountain" unknown

Traditional education systems rely little on student input regarding the quantity, quality or sequence of course content. Lectures, labs and demonstrations are prepared and delivered by faculty in a prescriptive linear fashion. Learners are not allowed to customize the content. Therefore, content may not be based on real needs, but rather on perceived ones. Granted, an instructor is the individual who should be perceiving student needs and translating it into course content. Unfortunately, but necessarily so, instructors create material that targets the general student population. They can not compensate or allow for the extremes of the learner ability continuum.

Disregard of the needs of the learner impedes efficient effective learning. Typically, educational environments are based on the needs of the institution. Faculty, staff, legislative and administrative agendas appear to have a significant effect on the development and deployment of relevant learning environments.

From an instructor's point of view, the one major constant that impedes quality education is time. Instructors need time to spend with individual students, and time to gather extra materials in support of the process, thereby, developing more flexible learning environments.

Allowing for individual learner needs is extremely important. The reality is that there is a limited amount of time to do it in. It would be nice if educators could provide learning experiences that were easily customized to the needs of individuals. This would consist of environments in which students could take responsibility for learning. The author contends that technology can provide the infrastructure needed to enable this type of situation.

Educators can use new tools to be very creative and proactive in designing and delivering instruction. It is time to use them to achieve efficient and effective learning. It is time to take time to create and distribute customized learning environments that can provide visually rich and dynamic learning opportunities.

Technology

When education course content developers have the tools to create an electronic classroom, they will become the facilitators of large dynamic forms of information. Presently the opposite is usually true. The overhead of learning and implementing new technology into a course is often counter productive. It often demands too much time, is complicated and tends to creates large backlogs of pressing work that are nearly impossible complete. This is why it is important for educators to be

very cautious in their selection and utilization of available technology.

Being an educator in technical and computer graphics, the author has developed a very simplified approach to qualifying the validity and usefulness of a technology.

Basically, there are three questions to answer.

1. How difficult is the new technology to learn?
2. How much data does the software require to be useful?
3. Does the hardware and software support a *system approach* (Burton, 1995) solution to document creation and management?

The learning curve for some hardware and software seems to be beyond the ability of most educational practitioners. After all, why is the Macintosh computer and its software so successful in education? Simply because it is easy to learn and use. Apple understood early that the way to create useful tools was to make them easy to use. PCs have since adopted this same philosophy with the advent of Microsoft Windows operating systems (OS) and more recently the easy to use GUI of Microsoft NT OS.

Until recently, the basic underlying computer technology for the Internet was the UNIX OS. Those educators with UNIX knowledge were able to use it for developing and delivering Internet based education. The competitive playing field of educational products development was skewed toward these people.

UNIX systems require understanding and management skills that are not typical of most educators. With WIN95 and NT 4.0 from Microsoft (MS), the playing field is beginning to level. UNIX machine manufacturers are trying to maintain their market share against the easy to use` and almost as powerful, NT machines. The technology is migrating to the education profession masses. From this perspective, it appears that NT certainly deserves the time needed to learn and use it.

With the appearance of NT and WIN95 there is a logical migration for most of the data that has been created using Microsoft products. The idea of not having to re-key needed files to run on the World Wide Web (WWW), coupled with the recent Microsoft release of FrontPage, will permit functionally computer literate people to create and maintain a WWW site. This seems to set the stage for a relatively easy migration to NT or WIN95 systems.

Mac users have the same file creation and portability options within their OS with products like Adobe Pagemill and others. However, they do not appear to have a single solution to creating, editing and maintaining a web server that approaches the simplicity and ease of use that MS FrontPage offers. Not only can a PC user create and edit HTML documents, they can test and integrate them into their personal Internet server.

The combination of MS NT or WIN95 and FrontPage, with the ability to import usable existing electronic curriculum content, provides the technology components necessary to create and distribute WWW based instructional materials. Previously, most educational content developers have had to use others to test and maintain their web materials.

Stimulus and response

Unlike most states, Indiana does not have a network of state supported local community colleges. Instead, the two major universities maintain regional campuses. These regional campus programs are intended to be identical with the ones at the main campus. The intent is to provide seamless integration of students participating in a two year regional degree program and give them the opportunity to finish a four year degree on the main campus. From a financial point of view, this system makes a lot of sense. However, from a curriculum administration point of view, it creates tremendous time overhead for instructors.

Each department at the main campus is responsible for developing and delivering specific course content to the regional

campuses. Each course coordinator is required to distribute course materials to regional campus counterparts. The intent is to make sure that the content and sequence of the course is consistent with the main campus offering. Obviously, this situation creates overhead for the course coordinators.

Numerous questions and concerns from the regional sites is very time consuming. A straw-poll in the School of Technology (SOT) at Purdue University revealed that most faculty are concerned about the current system and its imposition on them. It is generally agreed that the intended regional campus process has merit. Unfortunately, there is not enough time. With current faculty teaching and research loads, it is almost impossible to provide the kind of guidance necessary to be successful within the existing process.

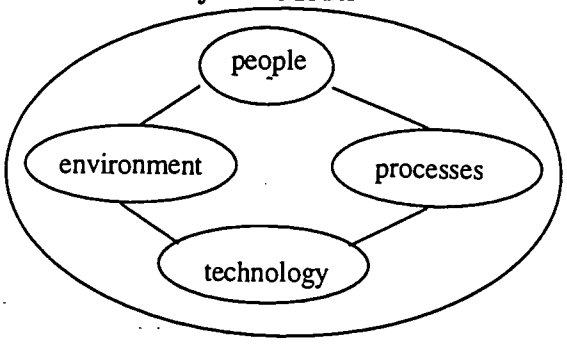
An obvious solution to the dilemma is to use the Internet as a means to provide access to the course information. With the emergence of the World Wide Web (WWW) and its user friendly graphical browsers, it seemed the technical possibility of delivering the kind of information required had arrived. Unfortunately, the limitations of the Hypertext Markup Language (HTML), Computer Graphics Interface (CGI) language and existing hardware were deterrents to a successful solution.

Regardless of the deterrents, when compared to the existing frustrations of administering the regional campus courses, it was time to attempt to use the WWW as a possible solution. The author's TG 105 Technical Sketching course, within the Department of Technical Graphics (TG) Curriculum, offered at numerous regional campuses, was selected as the first course to be placed on the WWW. This implementation consisted of using a system approach to designing, developing and distributing the electronic course materials (Figure 1). In this instance the model is applied to students, instructors and course developer.

The first step is to identify the **people** who are participants within the system. Any successful project should start by defining the intended audience. In this case, the students and instructors of TG 105 are the receivers (customers) of the development effort.

The course developer needs programmers, system administrators and graphics specialists to enable creation and migration of materials to the WWW.

Figure 1
System Model



The **environment** consists of traditional sketching tools and access to WWW enabled computers for the customers. Also, the course developer needs a production environment that will enable the creation of WWW compatible materials.

Processes relative to the sketching course content include psychomotor, affective and cognitive knowledge activities. The customers are responsible for traditional course content. Basically this consists of improving sketching skills and mastering the concepts that are the foundation of technical graphics.

The developer needs to be project manager for the development support team during the production process. Much like a business endeavor, work orders, work logs, deadlines, critical paths and other activities needed to plan and monitor a project are critical to its success.

Technology manifests itself in the form of WWW computers, browser software and printers for instructors and students. The course developer needs supporting electronic data files, HTML translation software, image mapping software, ftp software, WWW server, and other specialty software to be successful.

The product of the initial electronic curriculum effort is located on the WWW at

URL http://tech.purdue.edu/tg/course/tg105. To date it is very successful. The author has not had a single e-mail or phone call concerning the content or delivery of the course.

As successful as the initial WWW effort is there is still significant room for improvement. Two comments are worthy to note. First, it required over two hundred hours to develop and deploy the course. Much of this time was consumed in the production of needed unique or translation of non-compatible data. Second, the technical difficulties were very annoying and time consuming. Dealing with the development of the SOT WWW server infrastructure and finding usable software that was compatible with the author's abilities was difficult.

An initial assessment of the WWW development experience was that it took too long. Compared to previous time expenditures for regional campus course administrative activities, the electronic version took three times longer.

Thankfully, the evolving dynamic nature of technology came to the rescue. More powerful computers, friendly graphic user interfaces (GUI), data exchange speed enhancements and significant automatic easy to use WWW programming tools now make it possible to more easily and quickly create, distribute and maintain curriculum materials. The significant contributor to the new development environment is MS FrontPage.

TG now maintains many of its courses on line at the Uniform Resource Locator (URL), http://tech.purdue.edu/tg/courses/.

FrontPage

It is not the purpose of this paper to promote a single vendor or software. However, the preliminary indications are that the significance of FrontPage to educational materials developers, with average technical ability, warrants some discussion.

Most experienced educators are adverse to the impositions placed on them by emerging technology. Their stress, identified as *techno-stress* (Burton 1990), can usually be attributed to a failure to recognize the impact a new technology will have. Microsoft, in its continuing battle to define and promote the frontier of the Internet, created and freely distributed a new product called FrontPage. From this author's perspective, their effort to create a non-techno-stress Internet development tool is proving very successful and timely.

FrontPage is, according to M. Mathews (1996) in his book *Web Publishing with Microsoft FrontPage*, "...a very easy-to-use, full featured set of tools for the expert creation, delivery, and maintenance of web sites. And FrontPage does this in a WYSIWYG environment..." In short, technically challenged individuals now have a tool to create and maintain a rather elaborate web presence. Frames, discussion groups, easily created links, the removal of hard HTML coding and an easy to use GUI are just a few of its many attributes.

FrontPage can be downloaded from the MS home page at http://microsoft.com/sitebuilder. The software automatically downloads and configures on your machine at the appropriate prompts. There is a tutorial application within the software that is easy to use. The ultimate significance of FrontPage to the educational community is hard to predict. Realizing the potential that this software possesses will be a creative enjoyable endeavor. If control of the development and distribution environment is the issue, then FrontPage solves it.

Industry

To attain the vision of a truly dynamic virtual classroom, the author visualizes another attribute that is needed in WWW developmental efforts. That is the creation of intelligent student oriented documents. It is perceived that a database populated with discrete information that is capable of creating dynamic documents, at the request of students, is needed.

During the past four years, the author has designed and implemented numerous technology rich systems that are being used to provide virtual visual information to

customers. They consist of unique software products and visual libraries that provide the user on demand dynamic documentation. All of these systems focus on the lowest common denominator of PC technology.

Much like the previous discussion of the typical educator's limited technical envelope, these systems are designed for process functionally literate people that do not have the time or experience to use most industry communication technology products. They are not required to learn cryptic commands to get information. Workers can customize documents based on needs. Using the metaphor of the industrial Just-In-Time (JIT) processes, which provide only the materials and equipment necessary to perform a specific task, the dynamic on demand documentation system created by the author is called Just-In-Time Training (JITT).

The Next Step

Admittedly, HTML pages allow for hypertext links that provide avenues to more specific information. This information could be classified as a dynamic activity. The reality is that the links simply load onto the computer another static HTML document. Static, in this instance, refers to the pre-configured nature of most HTML and not the animation components of some pages. Although the later is dynamic in that it is animated, it is not dynamic in regard to its ability to change with different people accessing it.

Also, experience shows that most hypertext links tend to provide too many options and deter the focus of the inquiry. That is, when an inquiry is made to find information, it is not uncommon for the inquirer to wander off to some distant insignificant information. This is what is typically referred to as *web surfing*. Surfing the web is supposed to be a structured activity with a focus and goal. The reality, based on observations, tends to indicate that the original focus of a request becomes minimized when web surfing.

It seems that the WWW experience needs one more vital component. A component that attempts to prevent aimless wandering and provides a dynamic page assembly that includes information in a usable form. Not a series of URLs, but an assembly of information that appears to have some form of intelligence. It is proposed that this customization occur in the form of database activities similar to the previous industrial examples.

The dynamics of this new learner environment lie not only in the ability of the database engine to retrieve documents relative to the request, but to also provide only the amount of information needed to perform the task., i.e. JITT. This suggests that a record of student performance and abilities has a bearing on the quantity and type of information that the student receives. By logging on to a URL, the learner would bring all of their attributes with them. Previous class performance, academic history, reading ability levels, IQ, interests or any relative data deemed significant by the instructor to better customize the information. That is not to say that the learner could not access other information. Just that the results of the request would better fit the learner's abilities and needs.

Concurrent with a customized amount of data there would be a tendency to provide as much graphic visual information as possible. Since graphic information provides faster interpretation and comprehension, an attempt would be made to alleviate language and ability levels within the dynamic composite documents. This movement from text based documents is relative to the author's previous industrial observations and preliminary data that indicates a sixty-two percent task comprehension time savings for workers using dynamic documents over traditional documents (Burton, 1995).

System Attributes

A proposed dynamic JITT system would consist of an **Internet** (public area), **Intranet** (private area) and a **Development** area (Figure 2).

The **Internet** component is comprised of user information services. With a typical WWW look and feel, this accessible area is the final display area of dynamic data for the learner.

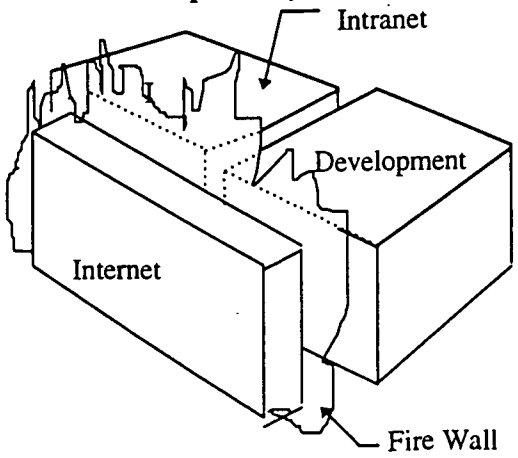
This site keeps track of user input and movement. It collects data from the user for the Intranet database. This data helps create the customized intelligence of the Internet display.

In the dynamic Internet, students can enter discussion areas, review syllabi, see student work examples, submit their work for posting, look at grades, read or print course material while viewing customized information for their developmental needs.

Residing behind a firewall and not accessible from the Internet , the **Intranet** is where sensitive documents, programs and program links reside. It is the repository of a large amount of data required for the success of the dynamic Internet experience. This area includes grade lists, class rosters, and other cumulative data that provides a profile of the user.

The **Development** area is where the project testing and other not ready for release components reside. Much like software alpha and beta versions, data in this area is highly proprietary and accessible only to the project managers and developers. This is a place to experiment and test ideas. Because of its rather volatile nature, the development area is isolated from the other areas.

Figure 2
Proposed Dynamic Web



Summary

The original intent of this paper was to present a current system that the author was using to create and distribute WWW course materials. But true to its continuing expansive nature, technology imposed heavily on the original concept. The issues and solutions that have transpired since the abstract for this paper was written have been significant. In short, the need and desire to further develop the original process proved to be unwarranted.

The original course materials are metamorphosing into a more significant and relative JITT product. As mentioned earlier, the current project can be observed in the author's personal URL at Purdue, http://knoy329.tg.purdue.edu/tg105. Use the "Cuss-n-Discus" hypertext link on the TG 105 home page to submit comments about the site. This is a closely monitored area so inquiries will receive an immediate response.

The obvious migration of the graphic emphasis in this proposed strategy is to use the Virtual Reality Markup Language (VRML). VRML is another powerful emerging tool that should further enhance the learner's experience. Purdue University TG Professor Dennis Short has a VRML sample running at http://knoy.337.tg.purdue.edu.

Dynamic JITT learning environments, delivered over the WWW, will have a significant impact on future education. They will provide learners with customized virtual learning that facilitates efficient utilization of time resources. The cumulative effect will be the expansion of student visual literacy. The dynamic JITT abilities will help reduce the inadequacies of traditional educational content delivery.

Now is an exciting time for educators and content developers. The opportunities are real. Motivated visionary developers are moving into an area that may prove to be the next frontier for education.

Technology has, and is, fulfilling its obligation to make the development and distribution of relevant course materials less difficult. All that is required of today's

educators is a commitment of resources for participation.

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